

# 16

## Medical emergencies and their management

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### Introduction

Medical emergencies by their very nature can occur at any time, without warning and not necessarily in the clinical environment. It is therefore essential to be able to recognise the nature of an emergency as soon as it occurs and to have the knowledge, proficiency and confidence to be able to undertake the appropriate remedial action.

### Management considerations

Therapists and hygienists treat patients of all ages and it is inevitable that some of these patients will have significant medical conditions and take medication, both of which may necessitate a modification to dental treatment. In addition many patients will experience anxiety associated with their treatment. It is to be expected that acute medical conditions will occur in a dental practice, albeit rarely. It is worth remembering that friends or family who often accompany patients, other visitors to the practice and staff may become unwell and require urgent attention. Medical emergencies can therefore occur anywhere on the premises, not just in the surgery. It is essential that all dental healthcare workers should have the knowledge and skills to recognise and provide appropriate immediate medical care for emergencies that might present in dental practice. In some instances this will require the provision of life-saving measures prior to the arrival of specialist help.

It is the professional responsibility of hygienists and therapists to ensure that:

- The equipment and drugs conform to contemporaneous standards recommended by respected bodies.
- All equipment is well maintained and all drugs are checked regularly and replaced prior to their expiry date.
- They are trained regularly in the use of the above.
- Regular 'in-practice' simulation of the management of medical problems including the preparation and administration of emergency drugs. This is in addition to training in cardiopulmonary resuscitation (CPR).

Regular **in-house** training in CPR is mandatory for the dental team. These sessions can be easily modified to include a rehearsal of managing other acute conditions that do not necessarily need to progress to a cardiorespiratory arrest, although this remains a possible outcome. Several scenarios can be devised around an unwell patient who has the potential progressively to deteriorate, such as a patient with angina who may develop severe chest pains or a patient who experiences breathing problems following the administration of amoxicillin. Regular rehearsal identifies problems that can then be rectified in a non-judgemental and constructive manner. Simulation training undertaken in a familiar working environment allows staff clearly to understand their role and the role of other members of the team, so helping to reduce confusion and panic when faced with a real emergency.

It is also important for members of the team to be cognisant with the different methods of preparation of the emergency drugs. This extends from turning on the oxygen supply and attaching the different types of face masks, to the opening of drug ampoules, and the drawing up and mixing of medications presented as powders with solvents (e.g. glucagon and hydrocortisone hemisuccinate). Adrenaline is available in glass ampoules and

**Table 16.1** Emergency equipment and drugs required in the dental surgery.<sup>1</sup>

Equipment	Drugs
Pocket mask with one-way valve and oxygen inlet	Oxygen
Self-inflating bag, valve and mask with reservoir (e.g. Ambu bag) in various sizes	Adrenaline (epinephrine)
Oropharyngeal airways <sup>2</sup> (various sizes)	Glyceryl trinitrate (GTN)
Oxygen therapy masks with tubing and appropriate connectors for oxygen cylinder	Aspirin
Syringes and needles to deliver emergency drugs by appropriate routes	Glucose
Intravenous cannulae and adhesive tape	Glucagon
Independently powered portable suction apparatus with wide-bore aspiration tips	Salbutamol inhaler
Blood pressure monitor <sup>3</sup>	Chlorphenamine <sup>5</sup>
Pulse oximeter <sup>3</sup>	Hydrocortisone sodium succinate <sup>5</sup>
Automated external defibrillator <sup>4</sup>	Midazolam
Automated blood glucose measuring device <sup>4</sup>	Flumazenil (if sedation with benzodiazepines is undertaken)

<sup>1</sup> Equipment should be free from natural rubber latex and resuscitation equipment must be available in suitable sizes for children.

Drugs must be available in preparations free from natural rubber latex, whenever possible

<sup>2</sup> These are also referred to as Guedel's airway

<sup>3</sup> Essential in a practice that carries out intravenous sedation

<sup>4</sup> This is not currently considered to be an essential item of equipment but clinical opinion may change

<sup>5</sup> These drugs are not considered to be first-line drugs

in preloaded syringes (with or without needles), and staff should be confident in preparing the drugs held in the practice. Preloaded syringes are more user-friendly, although there are still training issues to be addressed in assembling Minijet syringes.

It is imperative that training exercises are aimed at team building and therefore should be non-threatening. Consideration should be given to the management of patients who have collapsed in areas other than the dental chair or surgery. Toilets, with their confined space, can be particularly awkward and problematic. Locked toilet doors should be able to be opened from the outside so that emergency access can be obtained. Formal courses using scenario training for medical emergencies are provided by some postgraduate deaneries. **Immediate life support (ILS)** courses are organised by the **Resuscitation Council (UK)**. The authors consider it best practice for all clinical members of the dental team to receive annual training to ILS standards.

When first commencing work in a new practice it should be standard practice to identify where the emergency drugs and equipment are kept. You should be satisfied that these are adequate and comply with current guidance. Participation in team training for emergencies should ideally be part of the induction process when starting in a new place of work.

## The role of the hygienist/therapist

The General Dental Council (GDC) states that dental hygienists and therapists should:

- Be competent at carrying out resuscitation techniques.

- Have knowledge of how to identify medical emergencies and provide immediate management of anaphylactic reaction, hypoglycaemia, upper respiratory tract obstruction, cardiac arrest, fits, vasovagal attack, inhalation or ingestion of foreign bodies and haemorrhage (*The Development of the Dental Team: General Dental Council, 2005*).

Hygienists and therapists are capable of independent practice and may work when a dentist is away from the dental practice. When the dentist is present it is probable that he or she will assume the role of **team leader** in a medical emergency, although another, more experienced clinical member of the team may assume this role. In the event of an emergency it is hoped that those present would work as a team, with many of the staff making valuable contributions to the management of the patient. However, a dentist may not be on the premises and a therapist/hygienist may be the most senior person and lead the team; in fact, he or she may be the only staff member present. It is therefore important that the hygienist/therapist understands their role fully in a medical crisis and has a clear idea of what actions they would be prepared to carry out.

The guidance given by the GDC clearly indicates that the hygienist/therapist would be expected to perform CPR; it would be unacceptable for any clinical member of the dental team not to attempt CPR on a patient in cardiorespiratory arrest. There remains some uncertainty from the guidance given by the GDC as to what would be expected from a therapist/hygienist with regard to the administration of drugs. It can be assumed from the guidance given by the GDC that hygienists/therapists should administer oxygen. The GDC state that the

hygienist/therapist should have knowledge of how to identify medical emergencies and provide immediate management of anaphylactic reaction, hypoglycaemia, upper respiratory tract obstruction, cardiac arrest, fits, vasovagal attack, inhalation or ingestion of foreign bodies, and haemorrhage. Does *how to provide* mean that *you should provide*? It is the authors' opinion that hygienists and therapists should be able to administer first-line drugs for the patient. Therefore in the medical emergency section, which describes the comprehensive management required for each emergency, the hygienist or therapist would be expected to carry out essential primary treatment. This includes the use of the following drugs: oxygen, adrenaline, glucose, glucagon, midazolam, glyceryl trinitrate, aspirin and salbutamol. Further post-qualification training may result in new drugs being added to this list.

It must be appreciated that the overwhelming majority of clinical dental personnel are uncomfortable in managing a medical emergency and are unlikely to feel confident in administering emergency drugs, other than oxygen. This is because their experience is likely to be based solely upon their academic knowledge and clinical skills acquired during simulation training (hence its importance). Other than the management of faints, most dental staff will have little (if any) experience of managing medical emergencies for real.

### Avoidance of a medical emergency

Whilst it is accepted that all members of the dental team should be prepared to manage a medical crisis, steps should always be taken to try and prevent an acute condition from arising. In essence this involves:

- Having an accurate contemporaneous record of the patient's medical and drug history.
- Having a realistic and appropriate treatment plan.
- Identifying potential medical problems.
- Observing the patient.

Prior to treating any patient a detailed medical and drug history is essential, and this should be updated at each treatment session. Knowledge of a patient's medical status is part of **risk assessment**. Details of any medical history previously recorded in the clinical records should be read thoroughly and evaluated before the patient enters the surgery. When treating a patient with a significant medical and drug history, all staff involved in the care of the patient should know of, and understand, the relevance (if any) of the patient's current and past medical conditions. It is always prudent to ask patients if they have taken their medication as usual. Occasionally a patient will have the misconception that they should stop their regular medication on the day of dental treat-

ment. When this occurs the therapist/hygienist should seek advice from the dentist to see if it is safe to proceed with operative treatment. In the absence of any dentists, a member of **The Medicines Information Service**, who advise on drug therapy relating to dentistry, can be contacted by telephoning 0151 794 8206 (in the UK).

Patients (and sometimes guardians or carers) do not always disclose an accurate medical and drug history. When important questions remain unanswered or there appear to be inconsistencies or conflicting information then clarification should be sought from the patient's medical practitioner. Operative treatment should not be undertaken in the absence of a reliable medical history.

When a patient declares a significant medical condition it is often necessary to ask further in-depth questions in order to assess potential risks. An example of this is in patients who have **epilepsy**; it is essential to know how well their epilepsy is controlled and when they had their last seizure. The type of epilepsy should be documented and the patient asked for a description of their seizures. It is also helpful to know if they have warnings about their attacks. It is important to identify if they have ever gone into **status epilepticus**, and if so, how often. Any triggers that have been identified as precipitating a seizure should be documented in the records. Whilst all types of epilepsy should be recorded, the most dangerous seizure in the dental surgery is a generalised seizure, due to the greater possibility of injury and post-seizure complications. Patients who have frequent seizures should be asked for details about their recovery; for example, some patients sleep after a seizure. Ask this group of patients how they would like to be managed post seizure.

Treatment planning should be sensible and realistic and the medical and social needs of each patient should be taken into account. The timing and duration of appointments are important when treating patients with chronic disease. Table 16.2 highlights some factors that will influence treatment planning. Patients with **diabetes** should not be kept waiting and ideally treatment should not interfere with the timing of the patient's carbohydrate intake or administration of their medication. Patients who have **debilitating illnesses** and who get tired easily should have their dental appointments at a time that is most suited to their lifestyle. Sometimes carers and patients who have severe disabilities are unable to attend for early morning appointments. Patients who receive **kidney dialysis** should usually be treated on a day when they are not dialysed. A patient who has had a **myocardial infarction** within the last 6 months should only undergo simple emergency dental treatment due to an increased risk of dysrhythmias; routine, elective treatment should be deferred.

It is important that therapists and hygienists recognise dental anxiety in their patients. This is of paramount

**Table 16.2** Considerations when treating patients with a medical history.

When assessing a patient's health record it is helpful to consider the following possibilities:

- Are there any medical conditions that can affect any aspect of treatment? For example, in patients with cardiorespiratory problems, is their breathing adversely affected by chair position? In the patient with diabetes the timing and duration of the appointment need to take into consideration the timing of their anti-diabetic drug medication, meals and snacks. Does the patient have an illness that affects blood clotting?
- Is the medication taken by the patient likely to influence/modify the proposed dental treatment? Is the patient on warfarin? Are there any orofacial side effects associated with their medication?
- Does the patient self-medicate with a preparation that may be useful in the prevention or management of a medical emergency? Glycerol trinitrate or bronchodilators such as a salbutamol inhaler should be easily accessible if needed urgently.
- Are there any known allergies? In particular are there any severe allergies to substances (allergens) that the patient may be exposed to in the dental surgery? Does the patient carry epinephrine (adrenaline) for self-administration?

importance in those who have serious medical conditions that are exacerbated by stress (for example angina, hypertension or epilepsy). This group of patients should be asked if they are made anxious by any aspect of dental treatment, because pain control and effective anxiety control are essential to avoid a crisis. It may be safer to treat this cohort of anxious patients under sedation. Not all patients are suitable for dental treatment in primary care. It is often necessary to refer patients who have severe unstable medical conditions to a specialist unit when operative dental treatment is required. If there is uncertainty about the safety of managing a patient in primary care, advice should be sought.

It is always necessary to observe a patient clinically during dental treatment; careful observation will allow early recognition and prompt management of the unwell or deteriorating patient (Table 16.3).

It is rare for a medical emergency to occur without warning. When treating a patient there will usually be signs and/or symptoms which indicate a deteriorating condition. When a patient looks unduly pale, flushed or ill, ask them if they are feeling unwell. It may just be that they had a disturbed sleep, have missed a meal or are recovering from an illness. Such information is helpful in evaluating the patient. Patients who are clearly unwell should have their dental treatment deferred. When a patient has missed a meal and looks pale it may be prudent to administer glucose prior to treatment. Efforts should be made to relax or reassure a patient who arrives in a distressed state before any operative treatment is undertaken. Early recognition of a distressed or unwell patient can

**Table 16.3** Clinical monitoring.

#### Level of consciousness

Assess the patient's response to questions and commands and also their level of cooperation

#### Respiration

At rest, respiration should be regular, effortless and quiet; breath sounds should not be obvious. When there is obstruction on inspiration, increased respiratory signs are seen such as excessive abdominal movement. The number of breaths can be counted over a 30-second period and the rate calculated for 1 minute. The respiration rate should be around 14–20 breaths per minute for an adult, but may be as high as 30 in a child

#### Pulse

Assess the rate, regularity and quality

#### Colour of the patient

Assess the pallor of the face, the colour of the fingers. Visual signs of central cyanosis will only be detected by a skilled operator when the arterial oxygen saturation falls to below 85%. Hypoxia is therefore not clinically noticeable in the early stages and if hypoxia is a concern then the use of a pulse oximeter may be advisable. Patients will normally have oxygen saturation levels of 95–100%

#### General mood, demeanour, composure and body language

Ascertain if the patient is relaxed or agitated. When a patient is receiving dental treatment the operator and nurse should be aware of how comfortable or restless the patient is. A restless patient may fidget and appear tense; an anxious patient may have their shoulders hunched and their hands may become clenched or tighten around the armrests

sometimes prevent an acute incident or prepare the dental team for prompt action in the early stages of a crisis. Knowing when to summon expert assistance is also important. Always talk to the patient, ask them questions, as this will allow you to assess their level of consciousness. Any deterioration in consciousness is to be taken seriously and treatment should be stopped immediately.

#### Taking a pulse

A pulse results from the intraarterial pressure transmitted to arteries by the contraction of the left ventricle. A pulse represents the heart rate. Pulse points can be found in many **peripheral** or **major** arteries; often a pulse can be palpated (felt) when the artery crosses a bony prominence or it can be compressed against firm tissue.

The radial and brachial are the commonly used superficial pulses. The carotid and femoral pulses are major pulses and are used in the assessment of an unconscious patient. In a baby, however, the brachial pulse is used because the neck is poorly developed, making the carotid pulse difficult to feel. An average resting pulse rate for an adult is around 80 bpm (range 60–100). Children's pulse rates are faster.

When taking a radial pulse you should place your second and third fingers in the hollow immediately above the wrist creases at the base of the thumb, and press lightly. You should not use your thumb to record a pulse because it has a pulse of its own. Assess the rate (over a minimum period of 30 seconds) and calculate the value for 1 minute.

## An overview of assessment and treatment

A medical emergency can be described as a situation in which a patient's life may be at risk. The medical emergencies that are likely to be encountered in dental practice are shown in Table 16.4. This list is not exhaustive but it represents the commonly accepted conditions for which the dental team should be prepared.

The individual management strategies used for these conditions are discussed in more detail later in this chapter. However, it is also helpful to take an overview of the assessment and management of the unwell patient in order to identify principles that are common to all medical crises. This will help rationalise the actions taken and develop a common and rational approach. These are summarized in Table 16.5.

There are several actions that are essential when caring for the acutely ill patient:

- 1 Stop dental treatment.
- 2 Stay calm.
- 3 Shout for a colleague to help you.
- 4 Is the patient conscious or unconscious? Reassure the conscious patient and assess their level of consciousness.
- 5 Is the patient in a good position? Would lying flat, semi-reclined or being placed in the recovery position improve the situation?

**Table 16.4** Medical emergencies that can occur in the dental surgery.

Vasovagal attack (faint/syncope)
Hyperventilation (panic attack)
Seizures
Hypoglycaemia
Asthma attack
Cerebrovascular accident (stroke)
Angina
Myocardial infarction
Anaphylaxis
Airway obstruction (including choking)
Respiratory arrest
Cardiac arrest
Adrenal/steroid crisis

**Table 16.5** Common principles to apply in the management of medical emergencies.

Actions	Comments
Stay calm	
Shout for a colleague to help you	
Is the patient conscious or unconscious?	If unconscious try and rouse the patient
Reassure the conscious patient and assess their level of consciousness	Is the patient confused or alert?
Consider the position of the patient	If conscious make them comfortable, if unconscious lie them flat – consider the recovery position if they are breathing spontaneously
Assess and monitor the: <b>A</b> irway <b>B</b> reathing <b>C</b> irculation	A patent airway must be maintained
Would <b>D</b> rugs help?	Oxygen nearly always helps!
Note the time	This can be helpful in deciding when to summon the emergency services (e.g. in prolonged epileptic seizures, or in recording how long a patient remains unconscious)

### 6 Assess, monitor and maintain:

- **A**irway.
- **B**reathing to allow the diffusion of oxygen into the blood from lungs.
- **C**irculation of sufficient oxygenated blood from the lungs to the vital organs, thus maintaining the cardiac output.

### 7 Administer **D**rugs if required – oxygen is nearly always indicated.

### 8 Is specialist help required? If so send for urgent assistance.

### 9 It is good practice to note the time, as this can sometimes be helpful in decision making.

Assessment, monitoring and management of airway, breathing, circulation and the consideration of the administration of drugs are common elements in the care of the acutely ill patient. The *aide-mémoire* **A, B, C**, is a well-known acronym. The management of specific acute conditions and the use of medication will be discussed in greater detail later in this chapter. However, it is helpful if the reader analyses prevention (when applicable) and the causes and the management of each medical emergency in terms of **A**irway, **B**reathing and **C**irculation. **D** which usually stands for disability can be adapted to represent **D**rugs.

It is beneficial to review some basic physiology that is relevant to the management of medical emergencies.

This will help in the appreciation of how the cardiovascular and the respiratory systems are intricately linked and enable all tissues and organs to remain well perfused and oxygenated. This also explains why the position of the patient is important and how drugs might be helpful.

**Oxygen**, which is essential for the maintenance of human life, is inhaled into the respiratory tract and absorbed through the alveolar membranes of the lungs. The oxyhaemoglobin-rich blood is then distributed to all the tissues of the body due to the pressure generated by the heart contracting. The venous circulation returns the deoxygenated blood to the lungs, via the right side of the heart. For the cardiac output to be maintained blood needs to constantly flow in a circuit – this flow can be interrupted in a medical emergency. If blood ‘pools’ outside the central circulation (for example in the legs) then this will effectively reduce the venous return, which results in a fall in cardiac output and blood pressure. As a consequence of this there is a decrease in the amount of oxygenated blood reaching the brain and the resultant **cerebral hypoxia** (low oxygen concentration in the brain) will lead to a loss of consciousness and collapse. This change in position of the casualty, brought about by the collapse of the patient, should aid venous return and improve cerebral blood flow and allow recovery.

Venous return and cerebral blood flow are not only improved by lying the patient flat (as in a common faint) but can also be restored by the administration of drugs. An example where the circulating blood volume is reduced is **anaphylaxis**. In anaphylaxis, peripheral vasodilatation can occur as a consequence of the allergic reaction and the capillaries also leak fluid into the tissues. These two actions cause a reduction in circulating blood volume which can result in circulatory collapse. This can be rectified with drugs and intravenous fluid replacement. A first-line drug that can help restore the circulation is **adrenaline (epinephrine)**; this causes vasoconstriction and stimulates the heart to beat faster and with a greater force. During an emergency it is also essential that the circulating blood is rich in oxyhaemoglobin, hence the administration of oxygen should be considered for all medical emergencies.

When patients are having breathing problems due to narrowing of the bronchial airways as in **asthma**, inhaled **salbutamol** should be administered because it causes bronchodilatation. Some medical conditions will necessitate the administration of drugs to rectify a metabolic imbalance and improve the stability of the patient; glucose and glycogen are examples of this in a patient with low blood sugar.

A summary of the use of emergency drugs is given in Table 16.6 and a separate chart for the administration routes for emergency drugs is given in Table 16.7.

## Medical emergencies

### Airway obstruction

The airway may be obstructed by a foreign body (e.g. a tooth, food or denture), blood, vomitus, oropharyngeal oedema, laryngospasm and bronchospasm.

### Inhaled foreign body

In dental practice there is always a risk of foreign bodies, such as pieces of tooth or parts of restorations, being dislodged into the oropharynx and then being inhaled or ingested. If the foreign body has been ingested, it will usually travel through the gastrointestinal tract and be passed normally. If it is inhaled it may stimulate a cough reflex, or indeed choking if it is large enough. A small object can pass directly into the lower airway where it can cause a lung abscess if not retrieved. The best treatment is prevention, and the use of a dental rubber dam for restorative treatment is advised. Should an object be lost and the patient is not coughing or choking then the appropriate management is as follows:

- Check the patient’s mouth and clothing thoroughly and the filter/trap of the aspirator.
- If the patient is lying flat ask them to turn on to their side and lower the chair to a ‘head down’ position; this encourages gravitational forces to bring the object back into the mouth.

If the object cannot be located, inform the patient and contact the nearest A&E department for chest and abdominal radiographs. If the object is located in the respiratory tract the hospital will arrange removal as necessary.

### Choking

Airway obstruction in a conscious patient is easily diagnosed. Typically the person will appear distressed, may be choking and will usually point towards their neck or throat region to indicate the source of the problem. Choking can occur in the dental chair when water or a foreign body blocks the entrance to the trachea. A patient will usually cough to try and expel the blockage. When this happens, sit the patient up quickly and reassure them. The therapist/hygienist will also need to know how to deliver back blows and abdominal thrusts. Figure 16.1 shows the algorithm for the management of choking in an adult patient.

In the event of a partial airway obstruction in the conscious patient, coughing should clear the blockage; the patient should be encouraged to continue coughing. If the patient is starting to tire, deteriorate or show signs of cyanosis, immediate intervention is required and the

**Table 16.6** Indications and mechanism of action of drugs used in medical emergencies<sup>1</sup>.

Drug	Indications	Dose and route	Mechanism of action
Oxygen	Most emergencies but not beneficial in hyperventilation	Flow rate is variable – inhalation Supplemental oxygen: masks 4–6 l/min; nasal cannula 1–2 l/min Resuscitation 10–15 l/min	Prevents cerebral hypoxia
Adrenaline (epinephrine)	Anaphylactic shock	0.5 mg of 1:1000 (1 mg/ml), repeated at 5-minute intervals if required, IM For doses in children see Table 16.8	Suppression of histamine release Vasoconstriction which preserves blood pressure An increase in the rate and force of cardiac contraction Relaxation of bronchial smooth muscle which dilates the airways
Glucose	Hypoglycaemia, conscious patient	10–20 g oral	Rapid absorption; elevates serum glucose levels quickly
Glucagon	Hypoglycaemia, unconscious patient	1 mg, IM, SC or IV routes Children under 8 years give 500 µg	This hormone increases serum glucose by converting stored glycogen into glucose
Salbutamol	Asthma	200 µg (2 puffs) – inhalation	Relaxes bronchial smooth muscle so increasing the size of the airways
Glyceryl trinitrate	Cardiac chest pain/angina	400 µg metered dose, sublingual	Improves blood flow to the myocardium by vasodilatation of the coronary arteries
Aspirin	Myocardial infarct	300 mg, oral	The antithrombotic effect of aspirin reduces mortality after a myocardial infarction
Midazolam/diazepam	Status epilepticus	10 mg buccal or intranasal midazolam (child dose, transmucosal midazolam 200 µg/kg)	Benzodiazepines have antiepileptic action by inhibiting CNS activity
Chlorphenamine	Anaphylaxis, second-line drug	10–20 mg IM/SC or slow IV For doses in children see Table 16.8	Chlorphenamine is an antihistamine and helps reverse histamine-mediated vasodilatation (which makes the capillaries leaky)
Hydrocortisone	Anaphylaxis, second-line drug Status asthmaticus, second-line drug Adrenal shock, first-line drug	100–500 mg, IV or IM For doses in children see Table 16.8	In anaphylaxis it helps in the long-term stabilisation of the patient by reducing capillary permeability and inflammation Restores blood pressure
Flumazenil <sup>2</sup>	Over-sedation with a benzodiazepine	200–500 µg, IV	The antagonist of benzodiazepines: this will reverse sedation effects

<sup>1</sup> Drug protocols are constantly being updated and modified as new scientific information becomes available; it is the duty of the clinician to keep up to date with current guidance

<sup>2</sup> Flumazenil is mandatory only in practices where sedation with benzodiazepines is carried out

rescuer should remove any obvious debris from the mouth and commence up to five back blows. If there has been no improvement abdominal thrusts should be carried out (up to five). Check the mouth for any obstruction that can be removed and repeat the above cycles of five back blows followed by five abdominal thrusts until the obstruction is removed. If the casualty has lost consciousness then lay them flat. Check the mouth for any signs of obstruction, open the airway and begin CPR, i.e. 30 chest compressions followed by 2 ventilations.

There is no need to check the circulation. Chest compressions are commenced even if a pulse is present in the

unconscious choking victim. Undertake chest compressions and rescue breaths as required until help arrives.

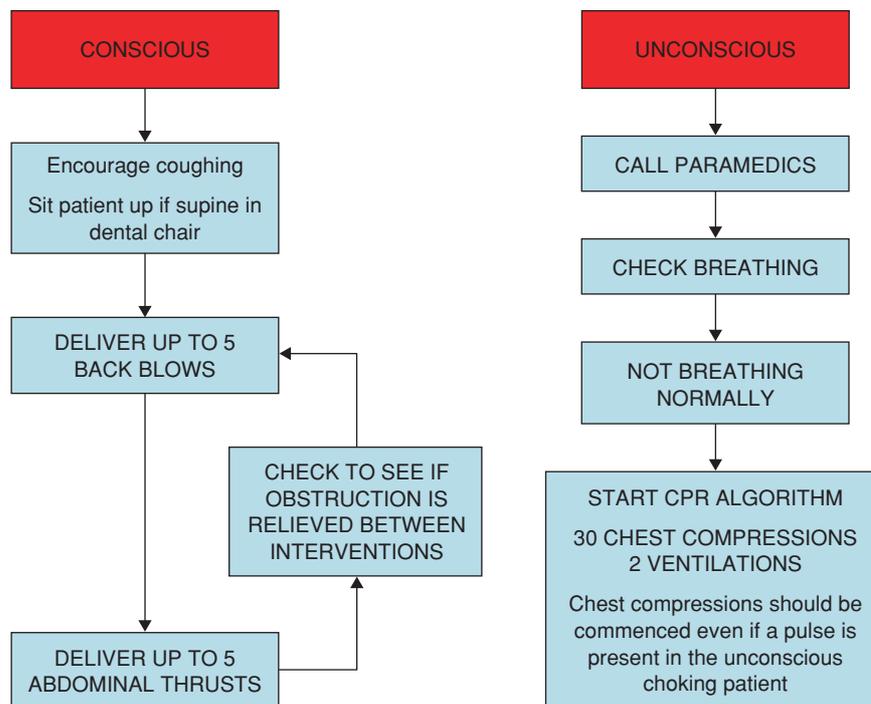
The techniques used in a choking adult include:

- **Back blows:** stand behind and to the side of the casualty. Use one hand to support their chest and lean the victim forwards. Use the heel of your hand to deliver five separate blows to the casualty's back firmly between the shoulder blades. Do this up to five times then re-evaluate for effect.
- **Abdominal thrusts** (also known as the **Heimlich manoeuvre**) involve the rescuer standing behind the

**Table 16.7** Routes of drug administration important in medical emergencies.

Route	Emergency drugs	Onset of action	Comments
Oral	Aspirin Glucose	30–120 min	
Transmucosal:			
■ Sublingual/buccal	GTN, glucose gel, midazolam oral liquid	1–5 min	10 mg/1 ml preparation
■ Intranasal	Midazolam	10–20 min	Use a dedicated mucosal atomisation device, using the 10 mg/2 ml IV preparation
Inhalation	Oxygen, salbutamol	1–5 min	If the asthmatic patient is not using the salbutamol inhaler properly use a spacer device (see text)
Intramuscular	Adrenaline (epinephrine) Glucagon Hydrocortisone Chlorphenamine	5–15 min	Use upper outer arm or outer thigh. No need to remove clothing if it is only a thin layer. For adrenaline aspirate to ensure that you do not give an IV injection <sup>1</sup>
Intravenous	Chlorphenamine Hydrocortisone	20–30 sec	In a dental setting the use of intravenous drugs is not essential in a medical emergency, other routes can be used. Attempts at IV access should not delay the provision of emergency drugs
Subcutaneous	Glucagon Chlorphenamine	15–20 min	

<sup>1</sup> IM is the preferred route of administration of epinephrine (1:1000) in anaphylaxis



**Figure 16.1** Algorithm for the management of choking in an adult patient.

casualty and encircling their arms around their upper abdomen. The rescuer makes a fist with one hand and places it over the casualty's epigastrium (midway between the navel and the xiphisternum) and firmly

grasps the back of this fist with their other hand. The rescuer suddenly brings both hands upwards and inwards in a quick sharp movement; it is hoped that this will dislodge the obstruction (Fig. 16.2). This



**Figure 16.2** Abdominal thrust (Heimlich manoeuvre).

motion is repeated up to five times. Evaluate between each manoeuvre to see if the foreign body has been expelled or forced into the mouth so that it may be removed by a finger sweep.

### The choking child

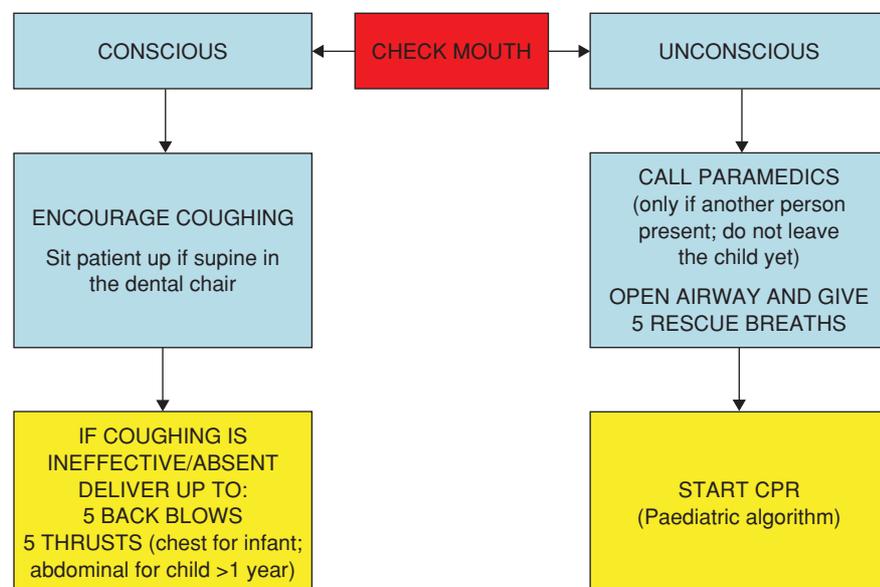
It is important to remember that you should never try to remove an obstruction blindly by placing your finger in the mouth. Children become hypoxic very quickly so if the obstruction persists the algorithm in Fig. 16.3 should be followed.

A baby or small child can usually be held 'upside-down' or placed over your knee on to their stomach (head down), and five back blows given. A larger child may be supported in a prone position with the head

lower than the chest; five back blows can then be delivered. If the obstruction remains, up to five chest thrusts can be tried. Place the child on their back again with the head lower than the chest if possible. Check the mouth carefully to remove any visible obstruction. Open the airway and check for breathing. If breathing is present then place the casualty on their side and monitor. If the child is not breathing try to achieve two effective ventilations out of five attempts at rescue breaths. If the obstruction is still present perform five back blows, followed by abdominal thrusts (rather than chest thrusts) and check the mouth again and repeat the cycle (see Fig. 16.3); alternate one cycle of chest thrusts with one cycle of abdominal thrusts. Do not perform abdominal thrusts on a baby as these can cause damage to internal organs; use only cycles of back blows and chest thrusts.

The techniques used in a choking child include:

- **Back blows:** use one hand to support their chest and lean the victim forwards. Use the heel of your hand to deliver five discrete blows to the casualty's back firmly between the shoulder blades.
- **Chest thrusts:** place the patient on their back with the head lower than the chest. Apply up to five short sharp compressions to the chest (similar to chest compressions in CPR, but deliver in a sharp and vigorous manner at a rate of around 20 per minute).
- **Abdominal thrusts:** the conscious patient is placed in the upright position (you may need to kneel when managing for a small child) and the unconscious casualty is laid on their back. The heel of one hand is placed in the middle of the upper abdomen. Five sharp thrusts directed upwards towards the diaphragm are delivered. Abdominal thrusts are not advised for an infant.



**Figure 16.3** Algorithm for the choking child.

### Airway assessment of the unconscious adult patient

The assessment of airway obstruction in an unconscious patient is best achieved using the systematic approach of **look, listen and feel**:

- **Look** down the line of the patient's chest and observe for movement.
- Place one ear over the patient's mouth and nose; **listen** for breath sounds.
- Simultaneously **feel** for expired air.

Airway obstruction may be partial or complete. When there is complete airway obstruction, respiration will be silent and there will be an absence of breath sounds from the patient. In a partially obstructed airway, efforts at breathing will be noisy. If inspiration is noisy (**stridor**) this is indicative of obstruction above or at the laryngeal level, e.g. semi-solid material may be present in the oropharynx. When expiration is noisy this tends to suggest obstruction of the lower airways, below the level of the larynx, as in asthma. The type of sound can suggest the cause of obstruction, for example:

- **Snoring**: caused by the tongue occluding the pharynx.
- **Gurgling**: suggests the presence of liquids or semi-solids in the airway.
- **Crowing**: indicative of laryngeal spasm.

The simple positional manoeuvre of a head tilt and chin lift can be successful, especially where the obstruction arises from relaxation of the soft tissues (Fig. 16.4). This method of opening the airway is not advocated in suspected fractures of the cervical spine. Sometimes a

jaw thrust is more effective at relieving obstruction of the oropharynx by the tongue. A jaw thrust advances the mandible and this releases the tongue from the posterior pharyngeal wall.

In the case of a partially obstructed airway, a finger sweep may be used in an adult or older child to evacuate solids or semi-solid material in the absence of suction apparatus. If the airway has been cleared and adequate spontaneous respiration is taking place, the patient may be placed in the recovery position and their condition checked frequently; this is especially important in patients who are vomiting.

The techniques used include:

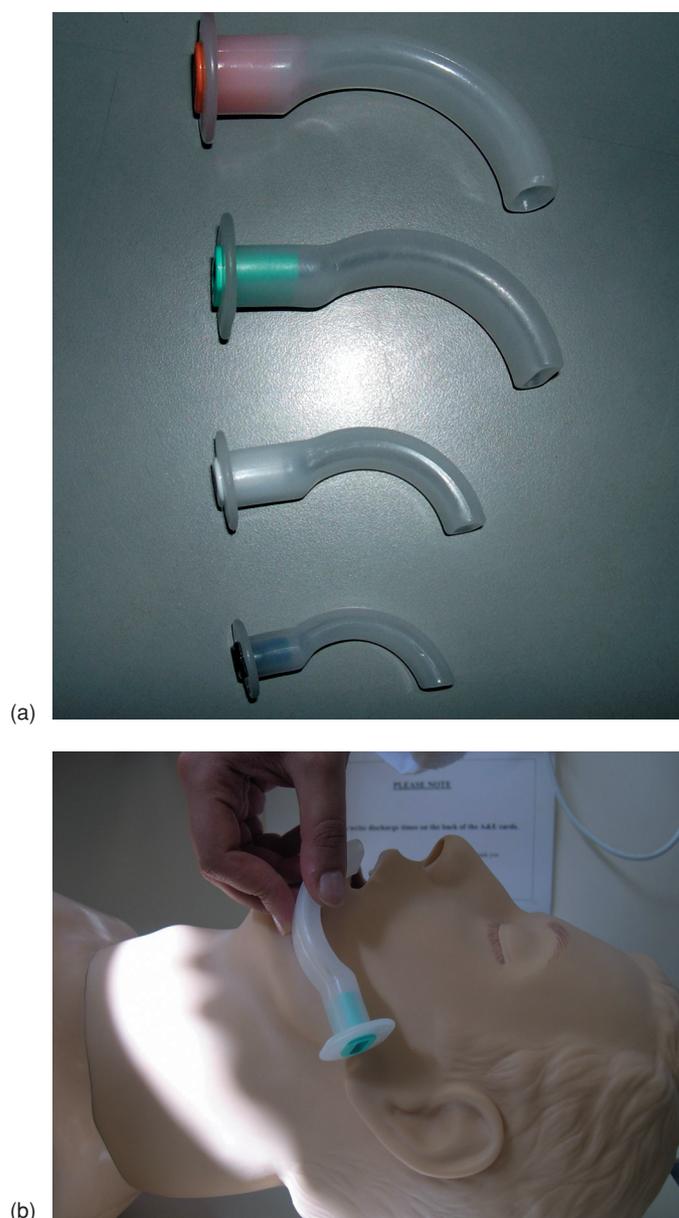
- **Head tilt and chin lift**: a clear airway may easily be achieved by simple backward tilting of the head by pressing on the patient's forehead. Further relief of the obstruction may be provided by supporting the chin. This can be achieved by placing your fingertips under the point of the patient's chin and lifting the chin forward.
- **A jaw thrust**: the airway can often be improved by advancing the mandible forward. This is done by lifting the mandible upwards and forwards by placing the index fingers behind the angle of the mandible. The thumbs are on either side of the chin ready to depress the mandible and open the mouth slightly.

### Airway maintenance using simple adjuncts

In an unconscious patient it may be necessary to maintain the airway using simple adjuncts; all clinical mem-



**Figure 16.4** Improving the airway using a head tilt and chin lift.



**Figure 16.5** (a) Oropharyngeal airways, sizes 1–4. (b) Sizing the airway.

bers of the dental team should be trained in their use. Oropharyngeal airways are designed to control backward displacement of the tongue in the unconscious patient but a head tilt–chin lift will usually need to be maintained. These airways come in a range of sizes from newborn to large adult. The most common sizes are 2, 3 and 4 for small, medium and large adults respectively (Fig. 16.5a).

The size required can be estimated by matching the oropharyngeal airway to the distance between the patient's incisors and the angle of the mandible (Fig. 16.5b). The airways are rigid, curved plastic tubes, and are flanged

and reinforced at the oral end to withstand pressure from the teeth. They are inserted in to the mouth in the inverted position and rotated through 180° whilst passing through the palate and into the oropharynx. If the patient shows signs of consciousness (coughing, vomiting, retching) remove the airway immediately. There are other airway adjuncts, e.g. nasopharyngeal airways, laryngeal masks and endotracheal tubes, which can be used by appropriately trained personnel.

### Supplemental oxygen

Oxygen should be considered for use in every medical emergency. The only medical emergency where it is not beneficial to the patient is in a hyperventilation/panic attack. Oxygen should be given at a flow rate of 4–6 l/min via an oxygen therapy mask in patients who are breathing. When spontaneous respiration is absent, artificial ventilation is obviously a necessity; this requires a high oxygen flow rate (10–15 l/min) to be given under positive pressure. The most efficient and secure way of doing this is to intubate the patient with an endotracheal tube. Dental personnel, however, do not usually have the skills to do this.

During resuscitation, oxygen can be given to a patient by a variety of methods; the simplest technique is mouth-to-mouth resuscitation. This is not ideal as it uses expired air from the rescuer which contains only 16% oxygen (ambient air contains 21% oxygen) and there are potential cross-infection issues. Some simple adjuncts are available in dental surgeries; the pocket mask, being the most popular device in the UK, has a number of advantages. It eliminates the need for mouth-to-mouth ventilation, which some people find distasteful and unacceptable. The use of a mask also reduces the potential for cross-infection. The mask is usually transparent so the rescuer can detect the presence of vomit or bleeding immediately. A non-return valve separates the two airways so the rescuer will not inhale the patient's expired air. It is also possible to attach supplemental oxygen, allowing oxygen-enriched air to be delivered to the patient. Whilst resuscitation using expired air with mouth-to-mask ventilation addresses cross-infection problems it still only delivers 16% oxygen, unless oxygen is administered directly into the face mask. When high flow oxygen is delivered to a pocket mask the patient can receive around 40% oxygen.

Although effective, the main difficulty with the pocket mask is the maintenance of an airtight seal between the mask and the face of the victim. If other staff are available it is possible for one person to hold the mask in place whilst another delivers rescue breaths. The mask is usually placed on the patient's face using the thumb and forefingers of both hands, lifting the angles of the jaw



**Figure 16.6** Self-inflating bag, valve and mask.

with the other fingers to obtain an airtight fit. Blow into the port of the mask to inflate the patient's lungs and watch for the chest to rise. Following each rescue breath, watch the chest fall to ensure expiration has taken place. If any leaks are noted, adjust hand position and/or contact pressure. It should be noted that a tidal volume of no greater than 400–500 ml/breath should be used in rescue breathing. Over-vigorous breaths can result in **gastric insufflation** (blowing air into the stomach), increasing the risk of vomiting with regurgitation and pulmonary aspiration. In addition over-enthusiastic rescue breathing may also lead to high inflation pressures.

Ventilation using a bag, one-way valve and mask connected to high-flow oxygen is a more effective way of delivering oxygen to patients with absent spontaneous respiration; this is shown in Fig. 16.6. The advantages associated with this device are:

- Supplementary oxygen may be given, increasing the oxygen concentration delivered to the patient from 21% to 45%.
- The addition of a reservoir bag (pre-filled with oxygen) and the administration of high-flow oxygen (10 l/min) will give an oxygen concentration of around 90%.
- This device may be fitted to an endotracheal tube or laryngeal mask airway.
- The patient's expired air is filtered into the atmosphere via a one-way valve.

The most notable difficulty with this system is maintaining an airtight seal whilst delivering ventilations.

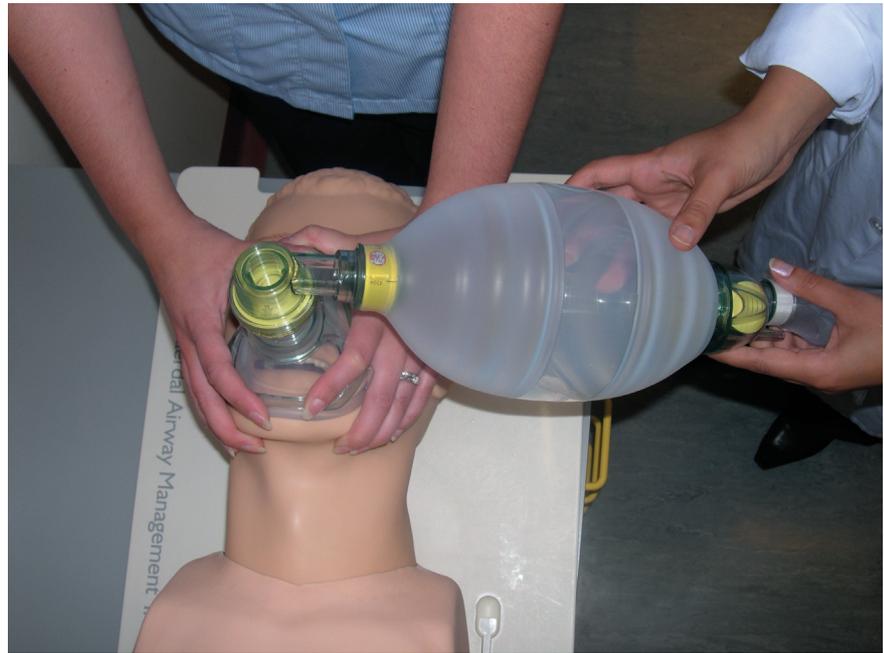
The percentages quoted above for oxygen depend upon the quality of the seal around the mask to the victim's face. To eradicate this problem, it is advised that a two-person technique is used wherever possible; one to hold the mask, the other to deliver ventilations (Fig. 16.7).

### Faints

A faint, also called **syncope** or a **vasovagal attack**, is the most common cause of loss of consciousness in dental practice. Fainting occurs when the blood supply to the brain is diminished (**cerebral ischaemia**) by a transient fall in blood pressure (**hypotension**). Predisposing factors include hypoglycaemia (low blood sugar), anxiety, fear, pain, hunger, stress, fatigue and a hot environment. Postural hypotension is also a possible cause and this classically occurs when the patient sits or stands up after treatment. A minority of patients have a tendency to faint.

### Signs and symptoms

The patient may feel unwell, light-headed, weak, confused, dizzy or nauseous. Obvious signs are usually apparent such as skin pallor and sweating; the skin feels cold and clammy. There will be a **tachycardia** (increased heart rate) followed by a **bradycardia** (decreased heart rate) and loss of consciousness. Muscle twitches can sometimes be seen as the patient is losing consciousness. Convulsions, cyanosis and incontinence can occur in the unconscious patient.



**Figure 16.7** Two-person technique for valve, mask and reservoir bag.

### Management

The management of a faint is to lie the patient flat; the legs can be elevated if staff are available and the patient has no known cardiac or respiratory problem (a pregnant patient should be placed on her side; this prevents the fetus from compressing the inferior vena cavae which would further reduce venous return). If the patient fails to regain consciousness after 3 minutes the diagnosis will need to be reassessed – give oxygen, call for medical assistance and monitor **A, B, C**.

Placing the patient flat improves the venous return, cardiac output and the cerebral blood supply. Alternatively a sitting patient may lower their head by placing it between their knees but this is not as effective as lying a patient down. Loosen tight clothing around the neck. Oxygen can be administered if time allows, but recovery should be quick (within 2–3 minutes). Reassure the recovering patient; a glucose-rich drink may be helpful. When a member of the dental team recognises that a patient is likely to faint, or the patient informs you of this possibility, the patient should be placed in a supine position; this may prevent loss of consciousness.

Enquiries should be made as to the possible cause, for example ‘When did you last have something to eat?’ ‘Are you prone to fainting?’. The incident should be recorded in the clinical records and the likely cause noted. When patients have a tendency to faint during dental treatment, treat the patient in the supine position, especially for administration of a local anaesthetic; this will eliminate the majority of vasovagal attacks.

### Hypoglycaemia

Hypoglycaemia is a deficiency of glucose in the blood stream. Precipitating factors in a known diabetic are anxiety, infection and fasting. This is sometimes seen in a patient with type I diabetes who has taken their insulin as normal but has not ingested a sufficient quantity of carbohydrate.

### Signs and symptoms

The patient will feel cold and may have clammy skin, be trembling, confused, have double vision, slurring of speech or show behaviour changes (e.g. they may become excitable, irritable, aggressive or uncooperative). Drowsiness and disorientation and loss of consciousness can occur.

### Management

In the first instance the management is aimed at elevating the blood glucose:

- **In the conscious patient:** administer 10–20 g of glucose in the form of a drink, tablets, sugar cubes or gel (e.g. Hypostop gel which is absorbed through the oral mucosa). Patients can be given 90 ml of non-diet Coca-cola or 200 ml milk which is equivalent to 10 g of glucose.
- **In the unconscious patient:** give 1 mg (1 unit) of glucagon by intramuscular (IM) or subcutaneous (SC)

injection. A child under the age of 8 years or less than 25 kg should be given 500 µg. This hormone increases serum glucose by converting glycogen stores into glucose. Administer oxygen and monitor **A, B, C**.

It is unlikely that dental staff would want to administer the alternative therapy to glucagon, consisting of a slow intravenous (IV) injection of glucose (25 ml of 50% solution). When the patient has recovered it may be necessary to give oral glucose to maintain blood glucose levels. Call the emergency services if the patient does not recover following the above measures; give oxygen and monitor.

### Epilepsy and status epilepticus

Epilepsy is a symptom of an underlying neurological disorder and is characterised by spontaneous, unprovoked recurrence of seizures. Seizures are likely to occur in a known epileptic when they are poorly controlled or do not comply with their drug regime. Some patients, however, have identified triggers that precipitate seizures, such as hypoglycaemia, stress, anxiety or odours.

Epileptic seizures generally last less than 5 minutes and are not usually considered as an emergency; **convulsive status epilepticus**, however, is an emergency that requires medical intervention. Convulsive (tonic-clonic) status epilepticus is defined as a generalised convulsion lasting 30 minutes or longer, or repeated tonic-clonic convulsions occurring over a 30-minute period without recovery of consciousness between each convulsion. During convulsive status epilepticus there is a risk that the patient may become hypoxic. Hypoglycaemia, brain damage from cerebral hypoxia and cardiac arrest can ensue. This condition carries an acute mortality rate of 10%. Status epilepticus can occur for all forms of epilepsy but non-convulsive status epilepticus is rare and the management is less urgent. A clinician should not wait 30 minutes to confirm a diagnosis of status; any convulsive phase of a tonic-clonic seizure that lasts in excess of 5 minutes should be treated as status. The incidence of status amongst epileptic patients is around 5%.

### Signs and symptoms

The clinical presentation of the seizure will depend upon the type of epilepsy that the patient has; this is a reflection of the area of the brain affected by the excessive electrical activity. Epilepsy may present as a disturbance of movement, sensation or behaviour with or without a loss of consciousness. Patients who have generalised clonic-tonic seizures (previously called **grand mal seizures**) will lose consciousness. The clonic phase con-

sists of jerking movements of the limbs and body; it is during this phase that the patient may bite their tongue and injure themselves. The patient may remain unconscious after such a seizure and may be confused. It can take an individual up to 2 hours for their cognitive function to return to normal.

When patients are accompanied, the escort may have a good knowledge of the natural progression of the patient's seizures. Seek their advice about how recovery usually proceeds; for example, does the patient normally have a sleep following a seizure?

### Management

Note the time the seizure started. Protect the patient from injuring themselves on any adjacent equipment. Remove potentially harmful objects and if necessary place pillows around the patient to protect them. It is helpful to cover the spittoon with a pillow if it cannot be pushed away from the patient. Administer oxygen if possible and monitor **A, B, C**. In the patient who had a convulsive seizure, ensure that they are discharged to the care of an escort in case the patient has post-seizure confusion. If the patient sustained general injuries during a seizure or had an atypical attack they may need to go to hospital.

When the seizure is prolonged or repeat seizures occur over a period exceeding 5 minutes, the patient should be regarded as having status epilepticus. **The emergency services** should be called and oxygen should be given, if possible. **Benzodiazepines** can be administered because of their antiepileptic action. **Midazolam** (10 mg) can be given by a transmucosal route. A preparation for buccal administration is available from Special Products Limited (Epistatus: Addlestone, Surrey) and contains 4 ml of 10 mg/ml midazolam in a viscous fluid, complete with four 1-ml syringes for ease of administration. Alternatively, undiluted midazolam for injection (the concentrated 10 mg/2 ml preparation) can be administered intranasally. A dedicated mucosal **atomisation device** can be used; this consists of an atomisation nozzle that attaches to the end of a hypodermic syringe. It should be noted that the use of buccal, intranasal and intravenous midazolam for status epilepticus is unlicensed. Midazolam (10 mg) or diazepam (10–20 mg) can be given by slow intravenous injection by someone competent in intravenous cannulation; alternatively diazepam can be administered in the form of a suppository. A child's dose regime for midazolam is 200 µg/kg. It is important to realise that benzodiazepines are not always effective in controlling status epilepticus and other antiepileptic drugs may be required. The patient should be monitored for **A, B, C**.

## Anaphylaxis

Anaphylaxis is a life-threatening allergic reaction that occurs once the patient has been exposed and sensitised to an antigen, such as natural rubber latex, certain drugs (most notably the penicillins) or additives to drug preparations, insect bites/stings and food (e.g. peanuts). Anaphylaxis caused by modern dental local anaesthetics is **exceptionally** rare, therefore other allergens should be considered in the first instance. In anaphylaxis there is a release of histamine and this causes a peripheral vasodilatation and causes the capillaries to leak fluid into the tissues; this reduces the intravascular circulating volume. The administration of epinephrine (adrenaline) reverses the vasodilatation and restores the circulating volume, so increasing venous return. **Bronchospasm** can also occur and cause respiratory distress. Hypotension and/or bronchospasm must be present for a diagnosis of anaphylaxis.

### Signs and symptoms

Initial flushing of the skin may occur followed by oedema of the face and neck; the tongue may become swollen. The patient may report altered sensations such as **paraesthesia** around the mouth and fingers. There will be a rapid weak pulse and skin flushing may occur; however, severe hypotension may be present and this will result in pallor. **Cyanosis** will accompany acute breathing difficulties with bronchospasm and possible laryngeal oedema. Loss of consciousness, respiratory and/or cardiac arrest are likely to ensue if the patient is not treated. The more rapidly the reaction to the antigen occurs, the more severe the symptoms tend to be. Symptoms can develop minutes after exposure to the antigen.

### Management

Treatment involves securing the airway and restoring the blood pressure. Call for expert assistance and monitor **A, B, C**. Administer oxygen via a face mask whilst maintaining the airway. The position in which the patient is placed will depend upon the symptoms and the severity of the reaction. It may be more comfortable for a breathless, conscious patient to be in a semi-reclined position. However, if the patient is hypotensive or loses consciousness, lie them flat. Administer adrenaline immediately (0.5 ml of 1:1000) intramuscularly and repeat if necessary over 5-minute intervals.

The administration of an **antihistamine** and a **steroid** will aid the patient's long-term stability and these should be considered for administration as second-line drugs. **Chlorphenamine** (10–20 mg) can be given by intramus-

**Table 16.8** Paediatric drug regimens for anaphylaxis.

Drug, age of child	Dose and route of administration
<b>Adrenaline<sup>1</sup></b>	
≥12 years	500 µg = 0.5 ml of 1:1000 IM 250 µg <sup>2</sup> if child is small
6–10 years	250 µg <sup>2</sup> = 0.25 ml of 1:1000 IM
6 months–6 years	120 µg <sup>2</sup> = 0.12 ml of 1:1000 IM
<b>Chlorphenamine</b>	
≥12 years	10–20 mg IM/SC/slow IV injection
6–10 years	5–10 mg IM/SC/slow IV injection
1–5 years	2.5–5 mg IM/SC/slow IV injection
<b>Hydrocortisone</b>	
≥12 years	100–500 mg IM/IV
6–10 years	100 mg IM/IV
1–5 years	50 mg IM/IV

<sup>1</sup> Repeat at 5-minute intervals if necessary

<sup>2</sup> Use a suitable syringe for measuring small volumes

cular or subcutaneous injection; alternatively it can be given by slow intravenous injection (over 1 minute). **Hydrocortisone sodium succinate** (100–500 mg) can be given by intramuscular injection or slow intravenous injection. The drug regimens for children are given in Table 16.8. Intravascular fluid replacement will be required but usually the paramedics will do this.

### Asthma

In asthma there is narrowing of the bronchial airways and this leads to coughing, wheezing and breathing difficulties. Bronchial asthma may be precipitated by exposure to an antigen, drugs (typically non-steroidal anti-inflammatory analgesics), air pollution, anxiety, infection and exercise.

### Signs and symptoms

There is breathlessness with wheezing on expiration. In addition there can be restlessness, difficulty in talking, tachycardia, low peak respiratory flow, using accessory muscles of respiration and cyanosis of the lips and nail beds. If untreated breathing may become increasingly difficult and the patient may develop status asthmaticus; respiratory arrest is also possible.

### Management

Administer the patient's bronchodilator (usually **salbutamol** or **terbutaline**) to relax the bronchial smooth muscle; if this is not possible, use the surgery's emergency inhaler to give two inhalations (salbutamol 100 µg/puff). Give oxygen and repeat the administration

of the bronchodilator if there is no improvement. Place the patient in a comfortable position and monitor **A, B, C**. If the asthma remains uncontrolled or deteriorates, summon the emergency services.

Status asthmaticus is a life-threatening condition. If a nebuliser is available then use this to administer 2.5–5 mg salbutamol nebulised combined with oxygen. When a nebuliser is not available and the emergency services have been called, the salbutamol inhaler should be administered every 10 minutes. Salbutamol is more effective in a large-volume spacer device and it is advisable for practices that have a large number of asthmatic patients to purchase a spacer device or nebuliser. Alternatively, the salbutamol inhaler mouthpiece can be inserted into a hole made in the base of a plastic/paper cup. Hydrocortisone sodium succinate (200 mg) can be given intravenously/intramuscularly whilst waiting for the ambulance. When asthma presents as a consequence of anaphylaxis, a bronchodilator (inhaler) may be given initially but epinephrine (adrenaline) should be given.

### Angina

Angina pectoris is a chest pain produced when the oxygen supply to the myocardium is inadequate. This is usually due to **atheroma** of the coronary arteries. The pain will stop if the myocardium receives sufficient oxygen. Anxiety or exercise can precipitate an attack in patients who are known to have angina.

### Signs and symptoms

There is usually an intense crushing chest pain which may travel down the left arm or into the neck and mandible. The patient may experience breathlessness, nausea or vomiting.

### Management

Administer the patient's own medication for relieving pain caused by angina – a nitrate spray or tablets. When this is not available give **sublingual glyceryl trinitrate** (GTN) spray (400 µg per actuation) and administer oxygen. Ensure that the patient is in a comfortable position, often semi-reclined as opposed to supine. Ask the patient if they need to sit more upright. Monitor **A, B, C**. If the symptoms do not resolve call the emergency services as it is possible that the patient is having a myocardial infarction.

### Myocardial infarction

A myocardial infarction (MI) (also called a **coronary thrombosis** or **heart attack**) is the death of a section of the

myocardium – usually the ventricle. This occurs because a portion of the heart muscle is deprived of oxygen (**ischaemia**). Arrhythmias frequently occur and ventricular fibrillation may ensue which may be fatal. A history of angina, cardiac arrhythmias and congestive heart failure will place a patient at risk from an MI. Predisposing factors in at-risk patients include stress, pain and infection. It is worth remembering that an MI can occur in patients who have had no previous cardiac symptoms.

### Signs and symptoms

The symptoms for an MI are similar to angina, but are more severe and prolonged; in addition the pain is not relieved by GTN. There is severe crushing chest pain that radiates down the left arm or into the neck and mandible. There is an irregular, weak pulse. The patient has an unhealthy pallor, is breathless, may vomit and loss of consciousness may ensue.

### Management

Give oxygen, a single dose of oral aspirin (300 mg) and call the emergency services. Sit the patient in a comfortable position. Reassure the patient and attempt to keep them as calm as possible. Monitor **A, B, C**.

Aspirin should not be given if there is a clear contraindication (e.g. a known allergy). If the patient becomes unconscious and a pulse cannot be detected, follow the protocol for cardiopulmonary resuscitation. The paramedics will usually give morphine for pain relief, but if you are in a sedation practice with a dedicated inhalation sedation machine and personnel trained in its use, then 50% nitrous oxide mixed with 50% oxygen can be a useful analgesic and anxiolytic. The majority of patients who die after an MI do so within the first hour. This is usually due to ventricular fibrillation.

### Hyperventilation

Hyperventilation, or panic attack, occurs when the breathing rate at rest spontaneously becomes abnormally rapid. This causes a fall in the concentration of arterial carbon dioxide which results in an **alkalosis**, giving rise to the characteristic signs and symptoms seen in hyperventilation. Stress, pain or anxiety can precipitate this increase in ventilatory effort. Hyperventilation can be associated with chronic generalised anxiety disorder.

### Signs and symptoms

These are rapid breathing (around 25–30 breaths/minute), increased depth of respiration, tachycardia, trembling, dizziness, blurred vision, sweating and **paraesthesia**

(tingling sensation) in the lips and limbs. Muscle pain and stiffness can lead to muscular twitching and tetanic cramps in the hands and tightness or pain across the chest. Hyperventilation can be prolonged and, whilst loss of consciousness can occur, it does so only rarely.

### Management

Stop treatment and remove all equipment from the mouth (including dental dam). Remove any equipment that may be considered to have provoked the condition (e.g. a syringe or forceps) out of the line of the patient's vision. Ask the patient to breathe slowly, around 4–6 breaths/minute. Rebreathing expired air can help restore normal alveolar carbon dioxide levels. This can initially be done by asking the patient to breathe in and out of their cupped hands.

Hyperventilation can be difficult to stop and can be frightening for patients who tend to interpret their symptoms in a catastrophic manner; they often feel they have a cardiac problem or that they are suffocating. These negative thought processes increase their anxiety. Reassurance is therefore essential and staff should act in a calm and controlled manner. Ensure that the patient is in a comfortable position, usually sitting upright. The patient should be told that their symptoms will resolve once breathing returns to normal. The rationale for the treatment should be explained to the patient so as not to induce further panic. A full face mask can be used, instead of cupped hands, to ensure rebreathing of carbon dioxide.

Hyperventilation is an acute condition in which oxygen is **not** beneficial to the patient. Very rarely would the administration of an anxiolytic, such as midazolam, be indicated. The long-term management of the anxious patient who is predisposed to hyperventilation attacks may involve relaxation exercises, behavioural therapy and the possible use of sedation for operative dental treatment.

### Cerebrovascular accident

A cerebrovascular accident (CVA), also called a stroke, occurs when there is a haemorrhage or obstruction (a **thrombosis** or **embolism**) in one of the cerebral blood vessels. This causes an interruption of the blood supply to an area of the brain. There is a resultant sudden attack of weakness affecting one side of the body. Hypertension, diabetes, renal disease, atherosclerosis of the cerebral arteries and a history of **transient ischaemic attacks** (TIAs, or mini-strokes) will all increase a patient's susceptibility to a CVA.

### Signs and symptoms

There is a variation in the onset and severity of symp-

toms from passing weakness or tingling in a limb to a profound paralysis, coma and death. The patient may complain of a sudden headache; they may have difficulty speaking and speech may be slurred. They may be confused and exhibit muscular weakness or paralysis down one side of their body (**hemiplegia**). There may be loss of consciousness.

### Management

Administer oxygen and ensure that the patient is in a comfortable position. Lie the patient in the recovery position if they lose consciousness. Call the emergency services and monitor the **A, B, C**. If you are uncertain whether there is muscle weakness in a conscious patient ask them to smile, raise both arms and say their name or address. These actions should highlight any muscular weakness. Prompt medical care is required as the patient may benefit from **thrombolytic drugs** (clot-busters).

### Local analgesic toxicity

Maximum safe drug values may be considerably reduced in patients with liver or kidney disease. As a consequence, the maximum safe dose of local analgesic agents, as advocated for a healthy patient, should be significantly reduced in the elderly, the young and patients with systemic disease (such as heart disease). This is especially important in patients with liver and kidney disease, in whom drug metabolism and excretion are impaired.

### Signs and symptoms

Light headedness, visual or hearing disturbances can occur. Agitation, confusion, seizures and respiratory distress can also develop. Initially the symptoms are those of central nervous system (CNS) excitation followed by CNS depression in severe toxicity. Loss of consciousness, respiratory and cardiac arrest can occur.

### Management

Lie the patient flat and administer oxygen, maintain the airway and monitor **A, B, C**. Summon expert help and perform CPR if required.

### Adrenal shock (Addisonian crisis, steroid crisis)

**Addisonian crisis** is due to a lack of production of corticosteroid hormones, which are normally produced by the adrenal glands. A patient with adrenal insufficiency may become **hypotensive** under stress, and collapse. Adrenal insufficiency can be caused by disease of the

adrenal glands themselves or by the use of long-term steroid therapy. In the latter group, patients can still be at risk of adrenal suppression despite having stopped their steroid therapy. A patient who has poor adrenal function and is undergoing a stressful operative procedure, such as surgical removal of mandibular third molars, is thought to be at risk from an adrenal crisis.

### Signs and symptoms

The patient will show signs of pallor, have a rapid weak pulse, rapidly falling blood pressure, confusion and loss of consciousness. When untreated, coma and death can occur.

### Management

Lay the patient flat and administer oxygen and summon expert help. Hydrocortisone 100 mg (preferably as the sodium succinate) is indicated intravenously or intramuscularly. This condition is an exceptionally rare emergency in dental practice. Reconsider the diagnosis if the patient does not improve.

## Cardiopulmonary arrest

### Respiratory arrest

A respiratory arrest may result from hypoxia, anaphylaxis, status asthmaticus, airway obstruction, drug or alcohol overdose.

### Signs and symptoms

The patient is unconscious and there is no breathing but a central pulse is present.

### Management

Follow the basic life support algorithm for rescue breathing (see Fig. 16.9); if untreated this condition will proceed to a cardiac arrest. Expert assistance should be summoned as soon as possible.

### Cardiac arrest

A cardiac arrest may result from a myocardial infarction, circulatory collapse, anaphylaxis, hypoxia or respiratory arrest.

### Signs and symptoms

The patient is unconscious and there is no central pulse.

### Management

Follow the basic life support algorithm. Expert assistance should be summoned as soon as possible to ensure early

defibrillation (if indicated) and administration of emergency drugs.

## Cardiopulmonary resuscitation (basic life support)

### Adult basic life support

All dental healthcare personnel are trained in cardiopulmonary resuscitation (CPR) which is also commonly referred to as **basic life support** (BLS). The term BLS implies that no equipment, such as airway adjuncts and oxygen, is used. In dental practice the term CPR is therefore to be preferred as it is more appropriate to the clinical setting; however, both terms are commonly used synonymously. It is important to emphasise that staff should be familiar with the current guidance from the Resuscitation Council (UK), which is updated from time to time and published on their web site ([www.resus.org.uk](http://www.resus.org.uk)).

CPR is the administration of oxygen to an apnoeic patient and the provision of external cardiac massage (to allow circulation of oxygen) to a pulseless patient, after accurately assessing the patient's condition and summoning appropriate medical support. The aim of CPR is to maintain adequate ventilation and circulation in order to prevent irreversible cerebral damage. Deprivation of oxygen in the cerebral blood vessels for 3–4 minutes (or even less if the patient was previously hypoxic) can cause irreversible brain damage.

The stages involved in treating a cardiac arrest can be summarised by Fig. 16.8: the chain of survival. CPR encompasses the first two links. The early arrival of a defibrillator and advanced life support skills are of paramount importance in managing a patient who has arrested. CPR is a very successful holding procedure but will not effect a cure for the patient in cardiac arrest; well-performed chest compressions give less than 30% of the normal cardiac output. The majority of all primary cardiac arrests in adults present in ventricular fibrillation and the importance of early defibrillation of this problem cannot be over-emphasised. The algorithm for BLS in adults is summarised in Fig. 16.9 and the sequence of actions is given in detail in the text below. Whilst this is correct at the time of going to press the reader must be aware that this guidance can change.

The procedure is as follows:

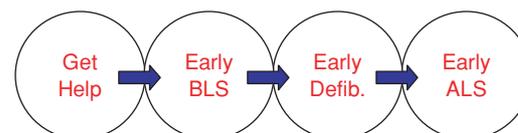
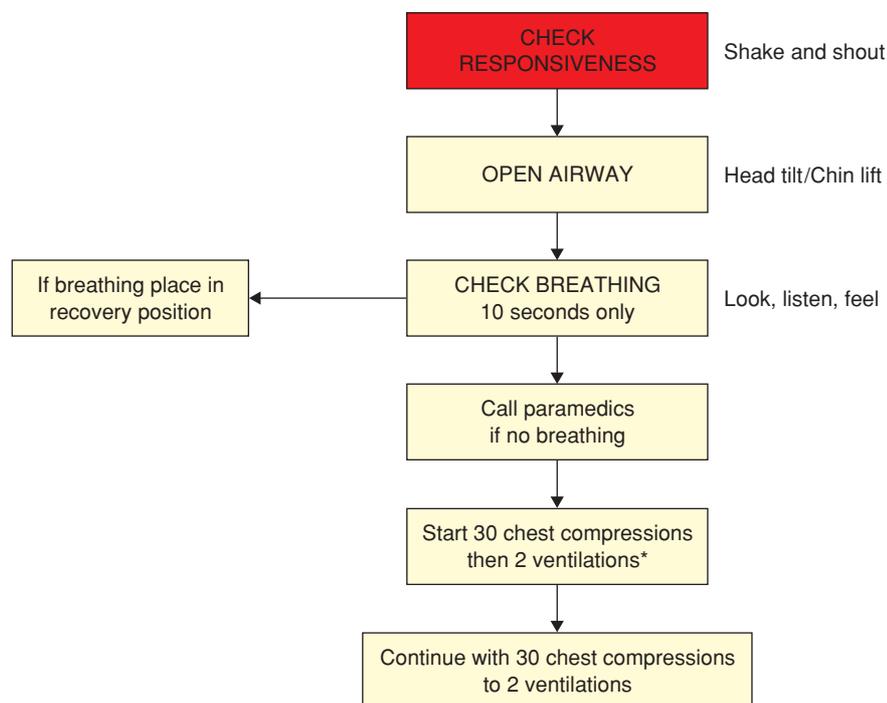


Figure 16.8 The chain of survival.



**Figure 16.9** The algorithm for basic life support in adults.

\*If you feel confident enough you may also check for a major pulse when assessing for signs of life. If a pulse is identified then rescue breathing only may be undertaken.

- **Safe approach:** the safety of the rescuer is of paramount importance; there is no point in you becoming the second victim. Check the surrounding area and the patient for signs of danger, and remove or minimise any hazard.
  - S Shout for help.
  - A Approach with care.
  - F Free from danger.
  - E Evaluate ABC.
- **Assess for a response:** stabilise the patient's head by placing your hand on their forehead and applying downward pressure and gently shake their arm and ask them, 'Are you all right?'. Be aware of the possibility that a casualty who has undergone a fall might have sustained an injury to the cervical spine, although this is more of a theoretical consideration in the context of a dental surgery. Nevertheless it is worth noting in your training sessions because staff may assist in an arrest that has occurred outside the surgery environment.
- **Shout for help:** call out to attract attention from people nearby; you will almost certainly require help. You should now proceed with a more detailed evaluation of the casualty.
- **Assess the airway:** this has been described in detail previously. Perform a head tilt and chin lift and examine the mouth for any visible material that could be causing an obstruction; remove any such material. When the patient is wearing dentures and in your

judgement they appear to be secure then leave them in place. The advantage is that they can give the face structure and support the lips; it is therefore easier to do mouth-to-mouth rescue breaths. However, you should remove loose and displaced dentures.

- **Assess breathing** (or for signs of life): this has been discussed earlier and is best summarised as 'look, listen and feel for 10 seconds'. If the patient is breathing spontaneously, place them in the recovery position before calling for expert assistance. If the casualty is not breathing call for specialist help before assessing the circulation.
- **Telephone for help:** irrespective of whether someone responded to your initial shouts for help, it is at this point that active measures should be taken to summon specialist assistance. If someone is available ask him or her to call for help, informing the emergency services that the patient has had a suspected cardiorespiratory arrest. Remember that basic life support is only a holding procedure and the casualty's chances of survival will improve with a defibrillator and personnel with advanced life support skills. To call the emergency services and request paramedic support in the United Kingdom you may ring either **999** or **112**. The digits 112 are pan-European digits that can be used within the European Union; also some mobile phone networks may require you to use 122 in the UK. It should be remembered that if you are on an internal telephone

network then another digit may be required to obtain an outside line. If you work in a hospital environment then you should follow the hospital protocol which will involve using a designated priority telephone number to call the local crash/emergency response team.

- **Check for circulation:** locate the carotid artery by feeling for the Adam's apple and sliding your fingers toward you until you meet the **sternomastoid muscle** (the diagonal muscle that runs down the neck from the base of the skull to the sternum), then check the pulse for no longer than 10 seconds. If there is a pulse the patient is in respiratory arrest so rescue breaths should be commenced. The protocol for treatment is to deliver 1 minute of ventilations – around 10 breaths – then the circulation is reevaluated. If there is no spontaneous respiration, then a loop is effectively created of 1 minute's worth of ventilation with a reevaluation of the patient's vital signs. This continues until help arrives or the patient is revived. If respiration is restored the patient should be placed in the recovery position and monitored.
- **Chest compressions:** when no central pulse can be felt (palpate for 10 seconds) a diagnosis of cardiorespiratory arrest is made. As a consequence external chest compressions are required and 30 chest compressions should be undertaken followed by two ventilations. This ratio of 30:2 must be observed irrespective of the number of rescuers. It may be interesting to note that lay individuals (non-healthcare workers) do not have to be able to locate a pulse to determine cardiorespiratory arrest. Citizens must satisfy themselves that the patient has 'absent life signs'. In addition it is acknowledged that lay people may be unwilling or unable to perform mouth-to-mouth ventilation but should be encouraged to undertake **compression-only BLS**. This approach is taken for hygienic reasons. Start chest compression as follows:
  - Kneel by the side of the victim.
  - Place the heel of one hand in the centre of the victim's chest.
  - Place the heel of your other hand on top of the first hand.
  - Interlock the fingers of your hands and ensure that pressure is not applied over the victim's ribs. Do not apply any pressure over the upper abdomen or the bottom end of the bony sternum (breastbone).
  - Position yourself vertically above the victim's chest and, with your arms straight, press down on the sternum 4–5 cm.
  - After each compression, release all the pressure on the chest without losing contact between your hands and the sternum.
  - Repeat at a rate of about 100 times a minute (a little less than two compressions a second).

- Compression and release should take an equal amount of time.

- **Ventilation:** ensure that the patient's airway is open and clear; reposition the head if necessary. Pinch the soft part of the nose to seal off the nostrils with your index finger and thumb. Take a full breath and place your lips over the mouth, making sure that you have a good seal. Blow steadily into their mouth for around 1 second, watching their chest wall rise. Take your mouth away and allow the casualty's chest to fall fully as air comes out; expiration takes around 2–4 seconds. Take another full breath and repeat the sequence, all the time maintaining a head tilt and chin lift. It is preferable, however, to use any airway adjuncts that are available such as a pocket mask. Ideally supplementary oxygen should be used.

### *Paediatric basic life support*

The reasons for paediatric basic life support are the same as those for an adult. Paediatric cardiac arrests, however, usually result from the casualty becoming hypoxic and then anoxic. Cardiac arrests in children are normally preceded by respiratory arrests (unless a child has a pre-existing cardiac condition). If this occurs then the outlook for the casualty is bleak, especially outside a hospital environment. This should not distract the hygienist/therapist from instituting CPR and performing it to the best of their ability. Many of the stages are the same as for adult CPR, for example the safe approach, assessment of responsiveness and the shout for help, and therefore the relevant text will not be duplicated. There are, however, significant differences in the BLS algorithm for children based upon the age of the child, when to call for help, and the rate of chest compressions and ventilations. The age groups for children are defined as follows:

- An infant is a child under the age of 1 year.
- A child is aged between 1 and 8 years.
- An older child is aged over 8 years.

The algorithm for BLS in children is shown in Fig. 16.10.

The key features of the procedure as follows:

- **Assess the airway:** in the child the head may be manipulated like that of the adult into a 'head tilt, chin lift', as in Fig. 16.1. However, to open the airway efficiently in the infant, the head should be manipulated into the neutral position. The infant's natural position of rest is a position of flexure. If the infant's head were to be hyperextended the airway is in danger of being kinked due to its short conical elastic properties. If there is suspicion of trauma then, like adult patients, the head and neck must be held in a neutral position and a jaw thrust performed in order to open the

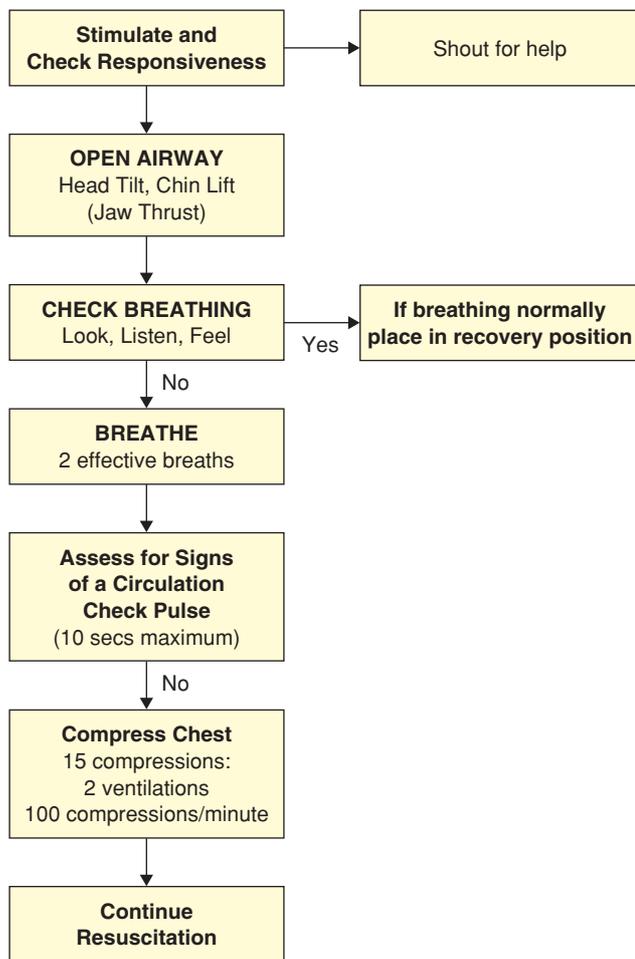


Figure 16.10 Paediatric basic life support.

airway. Finger sweeps are dangerous in the paediatric patient for a variety of reasons. In the infant, any foreign objects in the pharynx may become impacted. Also, the hard palate is not fully formed and that also may be damaged. By the age of 3–4 years a child may have hypertrophic tonsils. If a rescuer's finger nails inadvertently lacerate the tonsils it may have implications ranging from bleeding to severe mucosal swelling.

- **Assess breathing:** once you have ensured that there is a clear passage from the mouth to the lungs, determine if there is any respiratory effort. If there is, determine the breathing rate and place the patient in the recovery position and go for help. If there is no respiratory effort, ventilate the patient before calling for expert assistance. The way you deliver the ventilations differs from the adult BLS algorithm. If there is no ventilatory effort then deliver up to five ventilations. If you fail to deliver effective breaths then move on to the next part of the sequence (assessing the circulation). The method

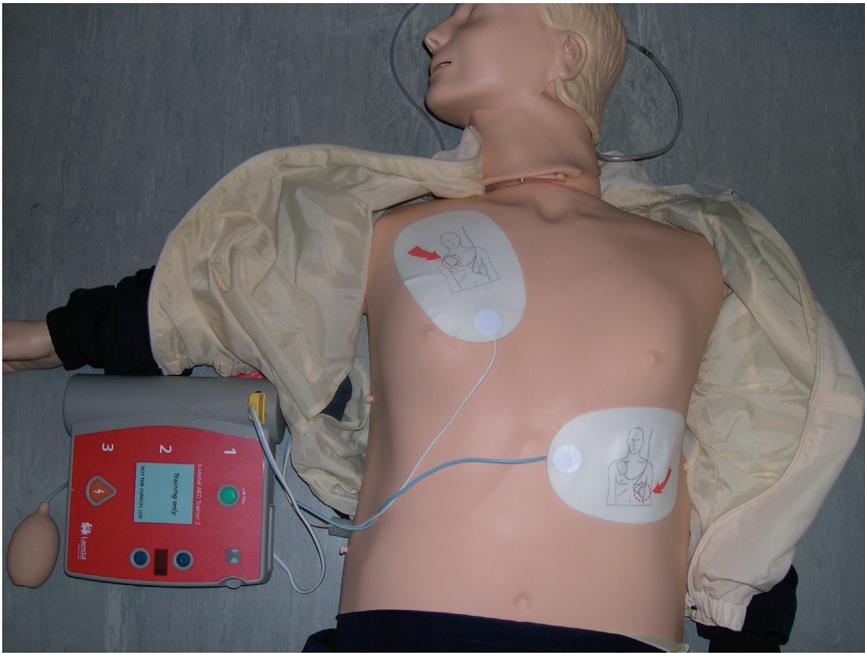
of delivering breaths depends upon the age of the casualty. In the infant you should place your mouth over the patient's mouth and nose and, using the air in your cheeks, get the patient's chest to have a perceptible rise and fall. In a child you may be able to pinch its nose and perform mouth-to-mouth ventilations. Yet again, you aim to have a perceptible rise and fall in the chest.

- **Check for circulation:** in children, the neck is reasonably well developed and the carotid artery can be palpated. In the infant you should palpate the brachial artery on the inside of the upper arm, in the antecubital fossa. This is preferable to the carotid artery which is difficult to locate due to infants having short necks. Alternative sites include the femoral artery or palpating in the **fontanelles** (anterior and posterior soft spots on the head) which remain open until around 18 months of age. By palpating the fontanelles, additional information may be obtained. For example, when the tissues at the fontanelles are recessed then **hypovolaemia** (a decrease in the amount of circulating blood) should be considered; if on the other hand the tissues are turgid then there is a suggestion of increased intracranial pressure. As in the adult, a lay individual does not have to be able to detect a pulse before commencing CPR.

- **Chest compressions:** once a diagnosis of cardiorespiratory arrest has been made then CPR should be performed. The compression:ventilation ratio is 15:2. The compressions should be performed with the heel of one hand placed on the lower half of the sternum and the sternum should be depressed to around one third of the depth of the child's chest. Over 8 years old the adult protocols of a 30:2 ratio may be followed. Irrespective of age, CPR should be performed at 100 compressions per minute.

- In the infant the land marks for chest compressions are as follows: one finger's breadth below the inter nipple line, placing two fingers below. This system is recommended for single rescue only. The preferred approach is to encircle the chest with your hand and apply pressure with both thumbs. This system works best with two or more rescuers and should be employed wherever possible. In both methods the chest should be depressed between 1 and 2 cm.
- In the age category from 1 to 8 years, the position for cardiac compressions is one finger's breadth off the distal tip of the xiphisternum, sliding the heel of your other hand adjacent to your land-marking finger. The pressure applied can be achieved by using one arm. The depth of compression is 2–3 cm.

Over 8 years of age the landmark and chest compressions are the same as those employed in adults.



**Figure 16.11** Automated external defibrillator.

- After having performed a minute's worth of resuscitation, seek help. If the casualty patient is a baby or a small child that you can easily carry, take your patient to the telephone and call for paramedic support.

### Defibrillation

The outcome of some cardiac arrests can be improved by the early use of defibrillation. A defibrillator will first analyse the electrical activity of the heart and this will dictate the action required. There are two broad 'categories' describing the rhythms of cardiac arrest according to whether or not they can be rectified by defibrillation.

- **Shockable rhythms** of cardiac arrest occur when the electrical system of the heart has developed a problem and is 'firing' indiscriminately; this uncoordinated electrical activity fails to produce a cardiac output. **Ventricular fibrillation** and **pulseless ventricular tachycardia** are the shockable rhythms of cardiac arrest and may respond to defibrillation.
- **Non-shockable rhythms** of cardiac arrest occur when the cause is not primarily related to a defect in the electrical conducting system of the heart and therefore applying electric shocks to the heart is not helpful. Asystole and pulseless electrical activity are examples of the non-shockable rhythms of cardiac arrest.

Defibrillators are available that advise the person using them. These **automated external defibrillators**

(AEDs) can be used almost anywhere and can be found in shopping centres, large railway stations and on aeroplanes. In these locations non-medical personnel are trained in their use. The machine comes with two electric leads each connected to an adhesive pad. The two pads are applied to the patient's chest (Fig. 16.11). The electrical rhythm of the heart is analysed and if it is a shockable rhythm, the machine can deliver a shock through the electrodes. Voice prompts are provided throughout to allow the operator to know exactly what to do and when. Staff wishing to use defibrillators must attend a formal ILS course and this should be updated annually. AEDs are not routinely recommended for use in children; instead manual defibrillators, which can be adjusted prior to the delivery of every shock, are used.

### Patient discharge

Following appropriate treatment of a medical emergency there are two possible outcomes:

- The patient recovers enough to be able to be discharged from the dental surgery.
- The patient requires transfer to a hospital for further diagnosis, treatment and/or monitoring of their condition.

There are many occasions when the patient will recover completely, for example after a simple faint, a hypoglycaemic episode, an angina attack or a panic

attack. It is always desirable for the patient to travel home escorted by a responsible adult. If the patient is not fit for discharge they will need to be taken to hospital; transfer to the care of the paramedics will therefore be necessary. It is helpful to know what information is required by the paramedics for the patient handover. As the therapist/hygienist may have carried out treatment for the patient, it is essential that the paramedics know exactly what has and has not been done.

### Paramedic transfer

Over the past two decades advancements have been made regarding the provision of treatment to the acutely ill patient from the **UK Ambulance Services**. Paramedics transfer such patients, as quickly as possible, to a secondary care centre that can deliver the necessary definitive care. At the same time the patient's airway and circulatory status are closely monitored and interventions are undertaken, as and when appropriate, prior to the patient's arrival at hospital. Paramedics working within the National Health Service possess many medical skills and some of the procedures that can be undertaken are:

- Endotracheal intubation.
- Intravenous cannulation.
- Administration of intravenous fluids.
- Manual defibrillation.

When a patient is transferred to the care of a paramedic, relevant information about the patient also needs to be exchanged. The patient handover can be simplified by using the acronym **SAMPLE**:

- Symptoms.
- Allergies.
- Medications.
- Past medical history.
- Last oral intake.
- Events prior to the incident.

In more detail:

- **Symptoms:** this includes the patient's symptoms and signs; for example, did the patient lose consciousness? Was there any pain? Did the patient have a seizure? What was their breathing and pulse like?

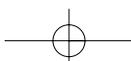
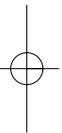
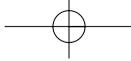
- **Allergies:** any known allergy should be reported to the paramedic team; even allergies that may be unrelated to the current medical crisis may be of relevance to the patient's treatment in both the ambulance and the accident and emergency department.
- **Medications:** a full drug history should be formulated by the dental team ready for handover.
- **Last oral intake:** dental staff may not always have this information but it can be helpful to the paramedic crew in assessing the potential for the patient to vomit, especially if intubation is required.
- **Events prior to the incident:** a comprehensive history should include those events that took place leading up to the incident that caused the 999 call, e.g. the patient had been given an antibiotic or had undergone surgery.

### Conclusion

Medical emergencies occur only rarely in the practice of dentistry. Nevertheless hygienists and therapists have a duty to ensure that they have the appropriate knowledge and skills to diagnose and manage the common medical emergencies that may be encountered in dental practice. Dental hygienists and therapists should be able to recognise when patients are too ill to receive dental treatment and when expert assistance should be summoned. They should be familiar with the location, preparation and administration of emergency equipment and drugs. It is the authors' opinion that hygienists and therapists should be trained to use the following drugs: oxygen, adrenaline, glucose, glucagon, midazolam, glyceryl trinitrate, aspirin and salbutamol. They should regularly update their knowledge and refine their skills by scenario training with all members of the dental team; trained colleagues are an invaluable resource in any crisis.

### References

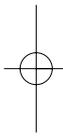
*British National Formulary 50* (2006) British Medical Association and Royal Pharmaceutical Society of Great Britain  
Resuscitation Council (UK) web site: [www.resus.org.uk](http://www.resus.org.uk)



# Self Assessment

## Chapter sixteen

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## Short answer questions

1. List five items of emergency equipment that should be available in a non-sedation dental practice.
2. List five emergency drugs that you should have available in a non-sedation dental practice.
3. List five medical emergencies that may occur in dental practice.
4. Does hypoglycaemia only affect patients with diabetes?
5. What is the first-line management of a patient who is having a tonic-clonic seizure?
6. How can the airway in an unconscious adult patient be improved?
7. When performing external chest compressions on an adult, how many centimetres should the sternum be depressed?
8. If you were trying to improve the airway on a patient with a possible neck injury, what positional manoeuvre would you make?
9. In resuscitation, what percentage of oxygen are you giving to a patient during mouth-to-mouth resuscitation?
10. During cardiorespiratory arrest, what flow rate would you use to deliver oxygen to the casualty?
11. What intramuscular injection sites would you use to deliver emergency drugs?
12. If a patient is in anaphylactic shock name two first-line emergency drugs that should be administered.
13. Name two second-line drugs that can be used in the management of anaphylaxis.
14. By what route is adrenaline given to a patient who is in anaphylactic shock?
15. What is glucagon and when is it used?
16. In what medical emergency is aspirin used?
17. Name two drugs that may be given by a transmucosal route.

18. The term AED is used as an abbreviation in immediate life support. What do the initials AED stand for?
19. Is ventricular fibrillation a shockable rhythm of cardiac arrest?
20. What is another name for the Heimlich manoeuvre?

## Multiple choice questions

For the following questions select the BEST response from the options provided.

1. If the rescuer's first TWO efforts to inflate the victim's lungs by expired air ventilation do not result in the victim's chest rising, the rescuer should:
  - (a) Reposition the head before the next sequence of rescue breathing.
  - (b) Perform four back blows.
  - (c) Perform four abdominal thrusts.
  - (d) Perform finger sweep.
2. If a patient faints in the dental chair, first of all you should:
  - (a) Lower the head and raise the feet.
  - (b) Open all windows and place wet towels on patient's head.
  - (c) Give oxygen.
  - (d) Assume they will go into cardiac arrest and start cardiopulmonary resuscitation.
3. What should you do first when you find an apparently collapsed victim in the doorway of your practice?
  - (a) Open the airway.
  - (b) Establish responsiveness.
  - (c) Perform a Heimlich manoeuvre.
  - (d) Check the victim's mouth for foreign bodies.
4. When one rescuer performs CPR on an adult victim, the recommended rate for chest compressions is:
  - (a) 100 per minute.
  - (b) 60 per minute.
  - (c) 15 per minute.
  - (d) 80 per minute.
5. During single-rescuer CPR when should a rescuer palpate the carotid pulse of an adult?

- (a) After ensuring it is safe to approach.
  - (b) Straight after assessing if respiration is present.
  - (c) Every 1 minute during resuscitation.
  - (d) After calling for the paramedics or cardiac arrest team.
- 6.** Why is it dangerous to leave an unconscious victim lying on his/her back with a pillow under the head?
- (a) It may be difficult for blood to get to the brain.
  - (b) It is difficult to tell when the victim regains consciousness.
  - (c) It may cause the tongue to obstruct the airway.
  - (d) It may cause serious neck damage.
- 7.** Excessive artificial ventilation pressure may:
- (a) Cause no harm to the cardiac arrest victim.
  - (b) Affect only adult victims.
  - (c) Produce vomiting.
  - (d) Affect only infant and children victims.
- 8.** In an adult, if breathing is not present after the airway has been opened, the rescuer should:
- (a) Begin chest compressions.
  - (b) Give a blow to the back.
  - (c) Check the pupils.
  - (d) Call the paramedics/cardiac arrest team.
- 9.** In mouth-to-mouth ventilation, the victim's dentures should normally be:
- (a) Removed because they are covered in bacteria.
  - (b) Left in (unless loose) as they help to make an airtight seal.
  - (c) Removed because they frequently obstruct the airway.
  - (d) Left in because it is illegal to remove them without consent.
- 10.** To perform chest compressions on an adult, one hand is placed on top of the other with the heel of the lower hand pressing:
- (a) Over the sternum.
  - (b) Over the ribs just to the right of the sternum.
  - (c) Over the upper third of the sternum.
  - (d) Over the xiphoid process.
- 11.** When performing single rescuer CPR on an adult, the correct combination of ventilations and compressions is:
- (a) 1 ventilation to every 5 compressions.
  - (b) 2 ventilations after every 30 compressions.
  - (c) 5 ventilations after every 1 compression.
  - (d) 30 ventilations after every 2 compressions.
- 12.** To open the airway of a victim with a suspected neck fracture, the rescuer should:
- (a) Perform the jaw thrust manoeuvre.
  - (b) Perform a tracheostomy.
  - (c) Not do anything until a doctor arrives.
  - (d) Tilt the neck backward.
- 13.** To determine whether or not an adult victim has a pulse, the rescuer should usually palpate the pulse:
- (a) At the carotid artery in the neck.
  - (b) At the femoral artery in the groin.
  - (c) At the brachial artery in the arm.
  - (d) At the radial artery in the wrist.
- 14.** The principal method used for opening the airway is:
- (a) Head tilt with chin lift.
  - (b) Turning the head to one side.
  - (c) Striking the victim on the back.
  - (d) Wiping out the mouth and throat with a finger.
- 15.** The pulse of a child victim who has been found unconscious and is not breathing should be checked:
- (a) Immediately after opening the airway.
  - (b) After ventilations are given.
  - (c) After alerting the emergency services.
  - (d) Before ventilations are given.
- 16.** Respiratory arrest is characterised by minimal or absent respiratory effort, failure of the chest or upper abdomen to move and:
- (a) Dilation of the pupils.
  - (b) Cardiac arrest.
  - (c) Swelling of the tongue.
  - (d) No air movement through nose or mouth.
- 17.** Below the age of 8 years the CPR ratio of chest compressions to ventilation irrespective of the number of rescuers is:
- (a) 15 to 2.
  - (b) 15 to 1.
  - (c) 10 to 1.
  - (d) 5 to 1.
- 18.** A diagnosis of cardiac arrest is made if the victim:
- (a) Is not breathing and has dilated pupils.
  - (b) Is unconscious and carotid pulse cannot be felt.
  - (c) Becomes unconscious having suffered violent chest pains.
  - (d) Cannot be roused, has dilated pupils and is not breathing.

**19.** Respiratory arrest:

- (a) Is always followed by cardiac arrest.
- (b) Is not a life-threatening condition.
- (c) May be followed by cardiac arrest unless something is done.
- (d) Is always treated by a respiratory stimulant drug.

**20.** Myocardial infarction:

- (a) Is the same as cardiac arrest.
- (b) Is always preceded by angina pectoris.
- (c) Is treated initially with epinephrine.
- (d) May be rapidly followed by cardiac arrest.

**Essay questions**

- 1.** Write an essay outlining the stages that you would perform in the assessment and management of a patient who has undergone cardiac arrest.
- 2.** Discuss the signs and symptoms that a patient may present with prior to and during a simple faint. List any predisposing factors and say how you would manage the condition.